

Duke Power Appendix R Reconstitution Oconee (ONS)

November 07, 2005



Purpose

- Present General Overview of Reconstitution Methodology
- Show how Reconstitution Data/Information is used as a direct input into the Fire PRA
- Discuss How Recent Staff Positions May Impact NFPA-805 Transition



Appendix R Reconstitution Safe Shutdown Methodology

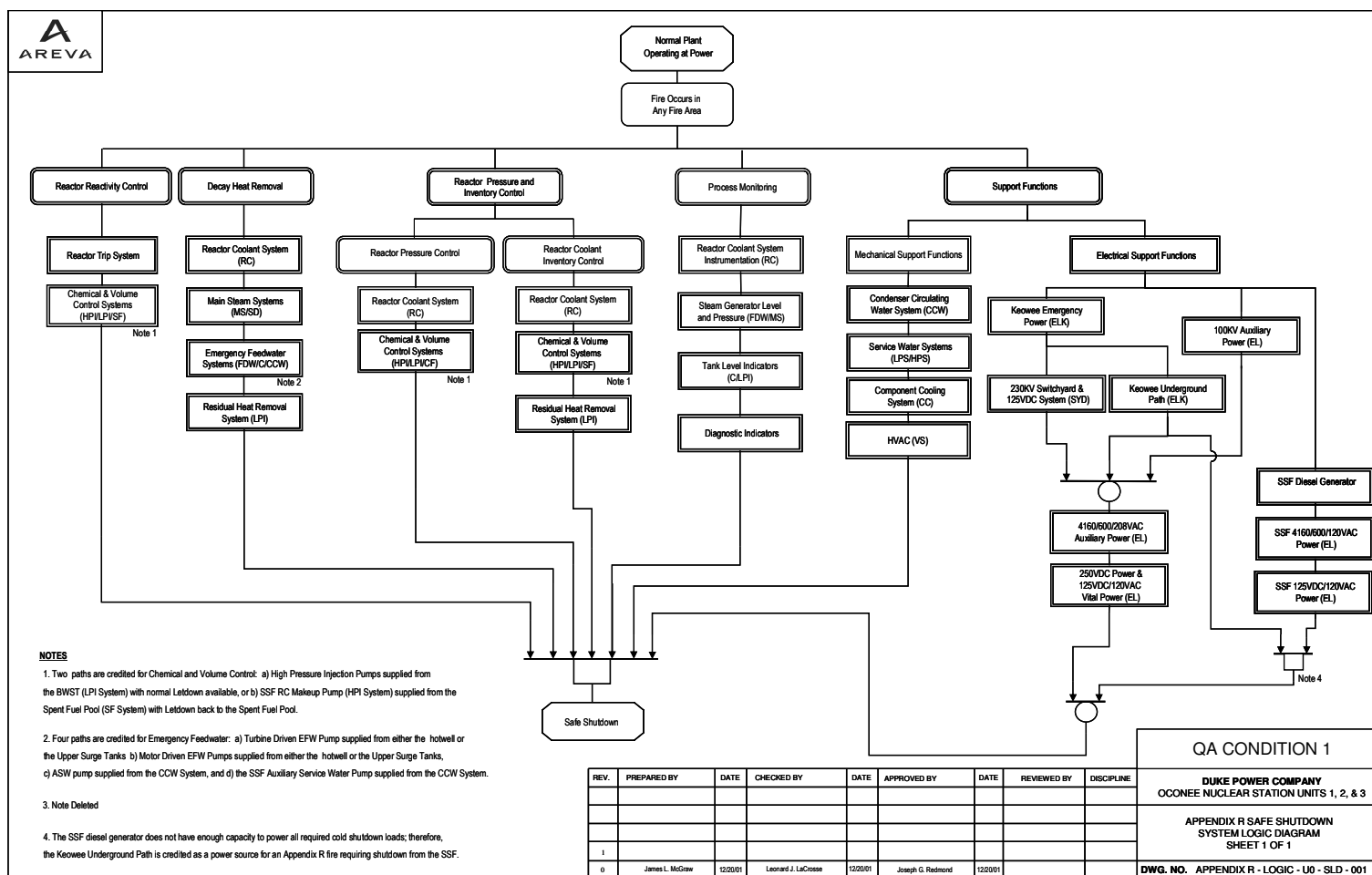
- Split into Three Phases:
 - Phase I – Safe Shutdown Equipment List (SSEL) and Logic Diagrams
 - Phase II - Cable and Fire Area Analysis - identifies all cable/component “hits”
 - Phase III - Performance Based/Risk Informed analysis of multiple spurious actuations in accordance with NFPA-805



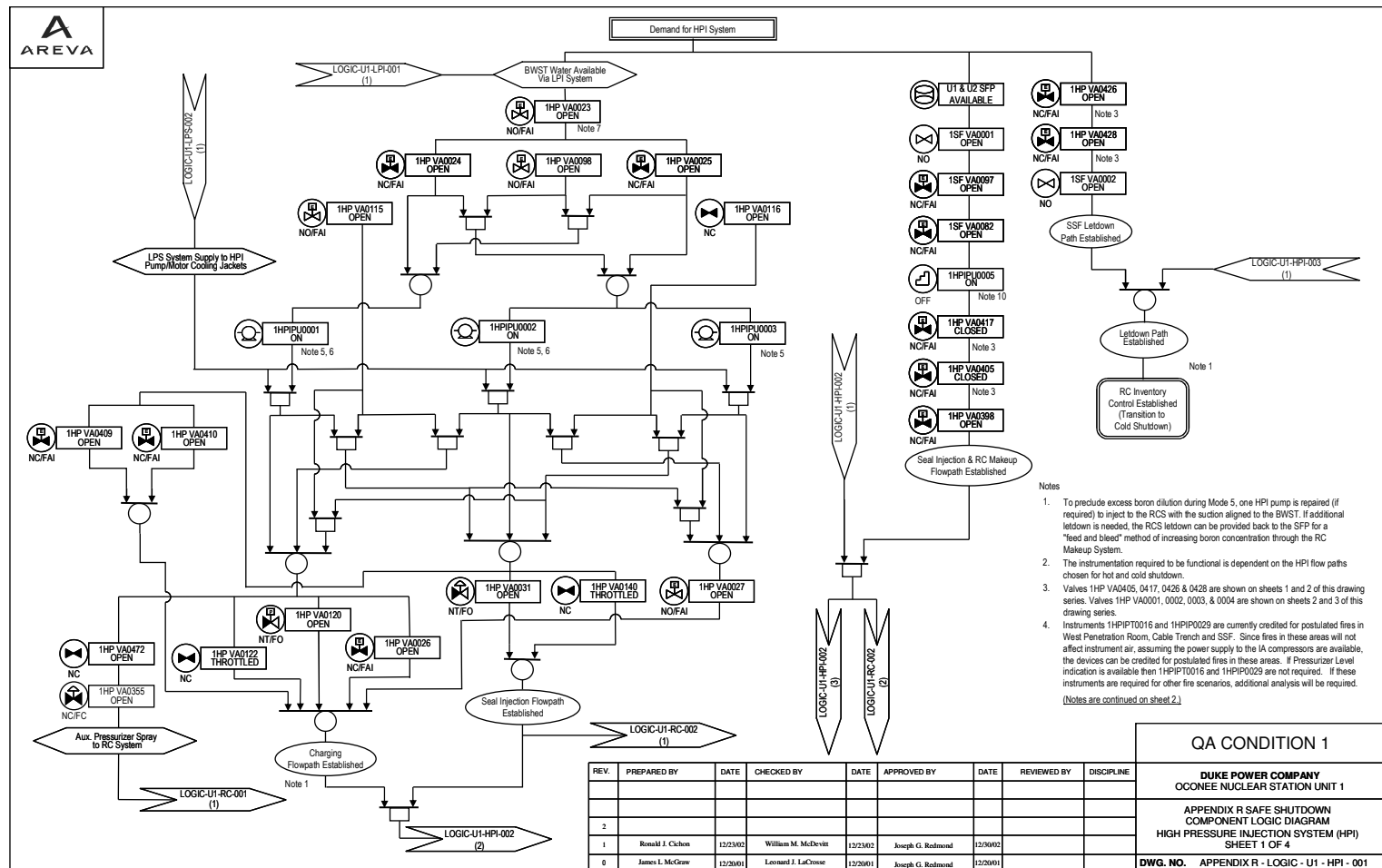
Appendix R Reconstitution Safe Shutdown Methodology - continued

- Phase I
 - Define Safe Shutdown Functions, Systems and Components
 - Safe Shutdown components listed in a Safe Shutdown Equipment List (SSEL)
 - System and Component Dependencies are documented on System and Component Logic Diagrams

Example System Logic Diagram



Example Component Logic Diagram – HPI System





Example Safe Shutdown Equipment List Page

Appendix R Fire Safe Shutdown Analysis Project
Oconee Nuclear Station Units 1, 2 & 3

51-5044354-000
Attachment B
Page 19 of 86

APPENDIX R SAFE SHUTDOWN EQUIPMENT LIST

Sorted by Unit, System, Train & Component

Unit	Sys	Elect Train	Component	Component Type	Component Description	Fire Area / Fire Zone	Alt Pwr	HSD	CSD	Hi/Lo	Positions					Logic Diagram Reference
											Normal	HSD	CSD	Fail Elect	Fail Air	
1	HPI	N/A	1HPI0363	Instrument	HIGH PRESSURE INJECTION FLOW A	BOP / 110	No	Yes	Yes	No	Available	Available	Available	Unavailable	N/A	U1-HPI-004
1	HPI	N/A	1HPI0364	Instrument	HPI FLOW B INDICATION	BOP / 110	No	Yes	Yes	No	Available	Available	Available	Unavailable	N/A	U1-HPI-004
1	HPI	N/A	1HPI0009	Instrument	H.P. INJ. PUMP "A" DISCH. PRESS.	BOP / 55	No	No	Yes	No	Available	N/A	Available	N/A	N/A	U1-HPI-004
1	HPI	N/A	1HPI0010	Instrument	H.P. INJ. PUMP "B" DISCH. PRESS.	BOP / 55	No	No	Yes	No	Available	N/A	Available	N/A	N/A	U1-HPI-004
1	HPI	N/A	1HPI0011	Instrument	H.P. INJ. PUMP "C" DISCH. PRESS.	BOP / 55	No	No	Yes	No	Available	N/A	Available	N/A	N/A	U1-HPI-004
1	HPI	N/A	1HPI0015	Instrument	HPI PMP DISCH. HDR. PRESS.	BOP / 54	No	Yes	Yes	No	Available	Available	Available	Unavailable	N/A	U1-HPI-004
1	HPI	N/A	1HPI0027	Instrument	U1 RC MAKE-UP PUMP DISCHARGE PRESSURE	RB1 / 122	No	Yes	Yes	No	Available	Available	Available	Unavailable	N/A	U1-HPI-004
1	HPI	N/A	1HPI0001	Pump	1A HPI PUMP	BOP / 55	No	Yes	Yes	No	On	On	On	Off	N/A	U1-HPI-001
1	HPI	N/A	1HPI0002	Pump	1B HPI PUMP	BOP / 55	No	Yes	Yes	No	On	On	On	Off	N/A	U1-HPI-001
1	HPI	N/A	1HPI0003	Pump	1C HPI PUMP	BOP / 55	No	Yes	Yes	No	Off	On	On	Off	N/A	U1-HPI-001
1	HPI	N/A	1HPI0005	Pump	U-1 SSF RC MAKEUP PUMP	RB1 / 122	No	Yes	Yes	No	Off	On	On	Off	N/A	U1-HPI-001
1	HPI	N/A	1HPI0035	Pilot Valve	LETDOWN ORIFICE INLET	BOP / 75	No	No	Yes	No	Energized	N/A	Energized	Deenergized	N/A	N/R (HPI)
1	HPI	N/A	1HPI0090	Pilot Valve	CONTROL'S LETDOWN ISOLATION VALVE 1HP-5	BOP / 108	No	No	Yes	No	Energized	N/A	Energized	Deenergized	N/A	N/R (HPI)
1	HPI	N/A	1HPI0091	Pilot Valve	PURIF. DEMIN. SUPPLY HDR. BYPASS	BOP / 57	No	No	Yes	No	Deenergized	N/A	Energized	Deenergized	N/A	N/R (HPI)
1	HPI	N/A	1HPI0092	Pilot Valve	PURIF. DEMIN. SUPPLY HDR. TO 1HPID0001 INLET	BOP / 57	No	No	Yes	No	Energized	N/A	Energized	Deenergized	N/A	N/R (HPI)
1	HPI	N/A	1HPI0093	Pilot Valve	PURIF. DEMIN. SUPPLY HDR. INLET (SPARE)	BOP / 57	No	No	Yes	No	Deenergized	N/A	Energized	Deenergized	N/A	N/R (HPI)
1	HPI	N/A	1HPI0094	Pilot Valve	PURIF. DEMIN. (SPARE) DISCH. HDR. OUTLET	BOP / 57	No	No	Yes	No	Deenergized	N/A	Energized	Deenergized	N/A	N/R (HPI)
1	HPI	N/A	1HPI0096	Pilot Valve	SV FOR CV 1HP-21 SEAL RETURN	BOP / 108	No	Yes	Yes	No	Deenergized	Energized	Energized	Deenergized	N/A	N/R (HPI)
1	HPI	N/A	1HPI0099	Pilot Valve	LETDOWN STORAGE TANK MAKE-UP FILTER "A" VALVE	BOP / 73	No	No	Yes	No	Energized	N/A	Energized	Deenergized	N/A	N/R (HPI)
1	HPI	N/A	1HPI0100	Pilot Valve	LETDOWN STORAGE TANK MAKE-UP FILTER "B" VALVE	BOP / 73	No	No	Yes	No	Deenergized	N/A	Energized	Deenergized	N/A	N/R (HPI)
1	HPI	N/A	1HPI0101	Pilot Valve	LETDOWN STOR. TANK MAKE-UP FILTER BYPASS VLV	BOP / 73	No	No	Yes	No	Deenergized	N/A	Energized	Deenergized	N/A	N/R (HPI)
1	HPS	N/A	1HPS0028	Pilot Valve	EFWP COOLING WATER BYPASS VALVE CONTROL	BOP / 24	No	Yes	Yes	No	Energized	Deenergized	Deenergized	Deenergized	N/A	N/R (HPS)
1	HPS	N/A	1HPS0017	Powered Valve or Damper	FIRE HDR. B. AUX. BLDG. TIE (1&2)	BOP / 43	No	Yes	Yes	No	Open	Open	Open	As Is	N/A	UC-HPS-001
1	HPS	N/A	1HPS0194	Electro-Pneumatic	TDEFDWP COOLING BYPASS	BOP / 24	No	Yes	Yes	No	Closed	Open	Open	Open	Open	UC-HPS-002
1	LP	N/A	1LP VA0001	Powered Valve or Damper	LPI RETURN BLOCK FROM RCS	RB1 / 122	No	Yes	Yes	Yes	Closed	Closed	Open	As Is	N/A	U1-LPI-001, U1-LPI-002
1	LP	N/A	1LP VA0002	Powered Valve or Damper	LPI RETURN BLOCK	RB1 / 122	No	Yes	Yes	Yes	Closed	Closed	Open	As Is	N/A	U1-LPI-001, U1-LPI-002
1	LP	N/A	1LP VA0003	Powered Valve or Damper	LPI HOT LEG SUCT	WP1 / 107	No	No	Yes	No	Open	N/A	Open	As Is	N/A	U1-LPI-002



Appendix R Reconstitution Safe Shutdown Methodology - continued

- Phase II
 - Identify cables for each component
 - Identify routing for each cable
 - Routing through each Fire Area documented
 - Fire Area damage assessments performed
 - Results of damage assessments used with Logic Diagrams to determine impact on Safe Shutdown Functions
 - Loss of Safe Shutdown Functions addressed through Appendix R Issue Resolution Process for spurious actuations within Design Basis





Example Safe Shutdown Cable Selection Worksheet Page

Appendix R Fire Safe Shutdown Analysis Project
Oconee Nuclear Station (Unit 2 Related)

51-5044354-000
Attachment F
Page 504 of 894

SAFE SHUTDOWN CABLE SELECTION WORKSHEETS

(Page 1 of 1)

Equipment Data							
Primary Equip ID:	2HPIPU0001		System:	HPI		Electrical Train:	N/A
Description:	2A HPI PUMP		Equip Type:	Pump			
Normal Pos:	On	HSD Pos:	On	CSD Pos:	On	Fail Air Pos:	N/A
Power Source:	2EL PL2DIA, 2EL SH2TC		OneLine Ref:	1702		Rev:	20
Incoming Intlks:	2EL-MFBV, 2ES-DODDCHPWR, 2HPI-P 0152, 2HPI-RCPST		EE Ref:	EE-217-19		Rev:	6
Outgoing Intlks:							
SubComponents:	N/A						
Add Equip Dwgs:	EE-217-1S(2), EE-250-11(7), M-302-86-16(D0), U2-HPI-001(2)						

Cable Selection Data							
Cable No.	Cable From Endpoint	From Dwg	Rev	Cable To Endpoint	To Dwg	Rev	Additional Cable Dwgs
2EDIA25	PNLBD 2DIA	1705	64	SWGR 2TC	1751-A	19	N/A
2ETC8	SWGR 2TC	1702	20	HPI PMP 2A	1702	20	N/A
2ETC801	SWGR 2TC	1751-A	19	2UB1	1711-C	55	1711-B(72), 1711-D(47)
2ETC802	SWGR 2TC	1751-A	19	ES CAB 4	1757-I	15	N/A
2ETC803	SWGR 2TC	1751-A	19	ES ODD CHNL RELAY CAB	1757-A	26	1757-F(5)
2ETC807	2MTC3	1766-D	49	2UB1	1711-C	55	N/A
2TC806	SWGR 2TC	1751-A	19	UCTC3	792-D	8	N/A

Preparer's Comments: None

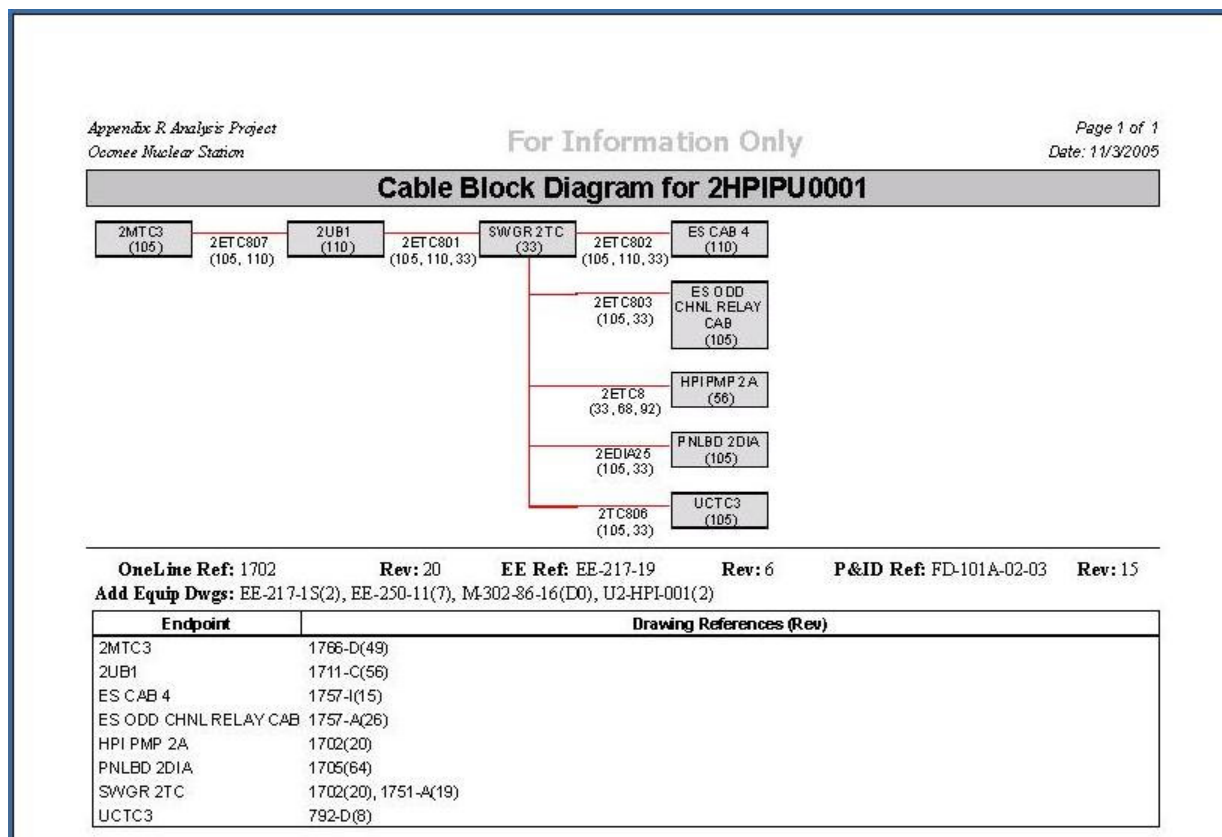
Prepared By: Gary Eshler

Date: 6/11/2003

Checked By: Larry Valmonte

Date: 6/24/2003

Example Cable Block Diagram





Example Cable Routing Worksheet Page

Appendix R Fire Safe Shutdown Analysis Project
Oconee Nuclear Station (Unit 2 Related)

51-5044354-000
Attachment I
Page 1431 of 3474

SAFE SHUTDOWN CABLE ROUTING WORKSHEETS

(Page 1 of 1)

Sorted by Cable

Cable: 2ETC801									
CDB	Seq	Junction Point / Endpoint	Fire Area	Fire Zone	FZ Bldg	FZ Elev	Col Ref	Drawing Reference	Dwg Rev
	0	2UB1	BOP	110	AB	822	P73	710	30
	0	SWGR 2TC	BOP	33	TS	796	K30	1930	46
1/2	1	B211	BOP	33	TS	796	N30	1930	46
1/2	2	2T4	BOP	105	AB	809	N74	710B1	1
1/2	3	2ME12	BOP	105	AB	809	-	-	-
1/2	4	2ME11	BOP	105	AB	809	-	-	-
1/2	5	2ME1	BOP	105	AB	809	-	-	-
1/2	6	2T15	BOP	105	AB	809	N73	710B1	1
1/2	7	2I-SLV-7	BOP	105	AB	809	N73	710	30
1/2	7	2I-SLV-7	BOP	110	AB	822	N73	710	30

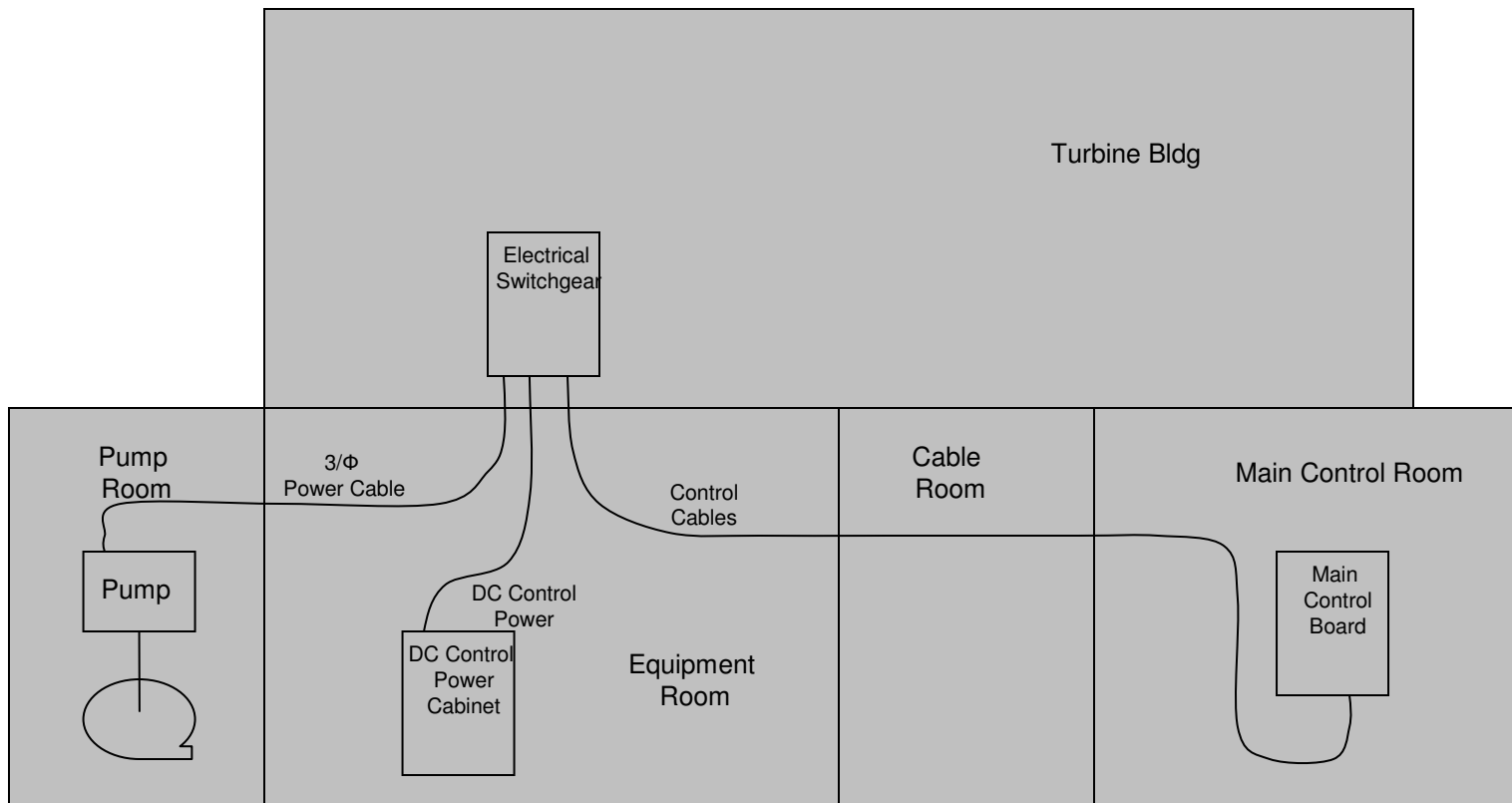
Cable Notes: Q.A. CONDITION 1:

Preparer's Comments:

Prepared By: Gary Birmingham Date: 2/10/2004 Checked By: Bill McDevitt Date: 2/26/2004



Example Simplified Cable Layout





Example Fire Area Compliance Assessment Page

Appendix R Fire Safe Shutdown Analysis Project
Oconee Nuclear Station (Unit 2 Related)

51-5044354-000
Attachment J
Page 31 of 107

FIRE AREA COMPLIANCE ASSESSMENT COMPONENT REPORT

Sorted by Unit, System, Train & Component
(Page 21 of 49)

Fire Area: BOP			Method Credited for SSD: SSF								
Safe Shutdown Components Affected from Cables/Equipment Located in FA											
Unit	Sys	Elect Train	COMPONENT	COMPONENT TYPE	DESCRIPTION	Fire Area/ Fire Zone	POWER SOURCE	NORMAL POSITION	HSD POSITION	CSD POSITION	DISPOSITION
2	HPI	N/A	2HPIF0004	Instrument	HPI FLOW B INDICATION	BOFV110	2EL FL2SKK	Available	Available	Available	A103 The process monitoring function is available from the SSF for a fire in this area.
2	HPI	N/A	2HPIF0009	Instrument	HP INJ PMP A DISCH PRESS	BOF55A	N/A	Available	N/A	Available	J009 Other equipment performs the HSD function of this equipment. PC100 This cold shutdown equipment can be repaired within 72 hours. Material, procedures, and manpower are available on site.
2	HPI	N/A	2HPIF0010	Instrument	HPI PUMP DISCH. PRESS	BOF55A	N/A	Available	N/A	Available	J009 Other equipment performs the HSD function of this equipment. J010 Other equipment performs the CSD function of this equipment.
2	HPI	N/A	2HPIF0011	Instrument	HPI PUMP DISCH. PRESS	BOF55A	N/A	Available	N/A	Available	J009 Other equipment performs the HSD function of this equipment. J010 Other equipment performs the CSD function of this equipment.
2	HPI	N/A	2HPIF0001	Pump	3A HPI PUMP	BOF66	2EL FL2DIA, 2EL SH2TC	On	On	On	A104 The reactor pressure control function is available from the SSF for a fire in this area. A106 The reactor coolant inventory control function is available from the SSF for a fire in this area. CP062 A procedural action is required to resolve an Appendix R concern with 2HPIF0001 in the fire area BOP. Secure Pump for HSD. Operate as required for CSD.
											PC100 This cold shutdown equipment can be repaired within 72 hours. Material, procedures, and manpower are available on site. PC013 Manually start 2HPIF0001 at local panel OEL SHTRF in the zone YARD per OPI 0041102004.
2	HPI	N/A	2HPIF0002	Pump	2B HPI PUMP	BOF66	2EL FL2DIC, 2EL SH2TE	On	On	On	A104 The reactor pressure control function is available from the SSF for a fire in this area. A106 The reactor coolant inventory control function is available from the SSF for a fire in this area. J010 Other equipment performs the CSD function of this equipment.
											CP062 A procedural action is required to resolve an Appendix R concern with 2HPIF0002 in fire area BOP. Secure Pump for HSD.
2	HPI	N/A	2HPIF0003	Pump	2C HPI PUMP	BOF55A	2EL FL2DIB, 2EL SH2TD	Off	On	On	A104 The reactor pressure control function is available from the SSF for a fire in this area. A106 The reactor coolant inventory control function is available from the SSF for a fire in this area. J010 Other equipment performs the CSD function of this equipment.



Appendix R Reconstitution Safe Shutdown Methodology - continued

■ Phase III

- As Dennis will be explaining in more detail, results of Phase II are combined with an extensive Multiple Spurious Review to address completeness of multiple spurious population
 - Deterministic Analysis Output (Phase II)
 - PRA Cut Set Review
 - Expert Panel Review



SSDA/Fire PRA

-
- All critical data originally entered into the Safe Shutdown Database (ARTRAK) forms the basis for the Fire PRA
 - Components
 - Cables
 - Cable Routes
 - Fire Areas/Zones
 - Intent is to make the SSDA and Fire PRA databases match, one-for-one



NFPA-805 Deterministic Methodology Transition

- In order to determine the need for Change Evaluations, each fire area must be evaluated to determine if it successfully meets one of the deterministic criteria in NFPA-805
 - One train maintained free of fire damage (old III.G.1)
 - Two trains in same area with deterministic solution (Old III.G.2)
 - 3 hour barrier between trains
 - 1 hour barrier with suppression and detection
 - 20 foot of separation with suppression and detection and no intervening combustibles
 - Alternate Shutdown (old III.G.3)

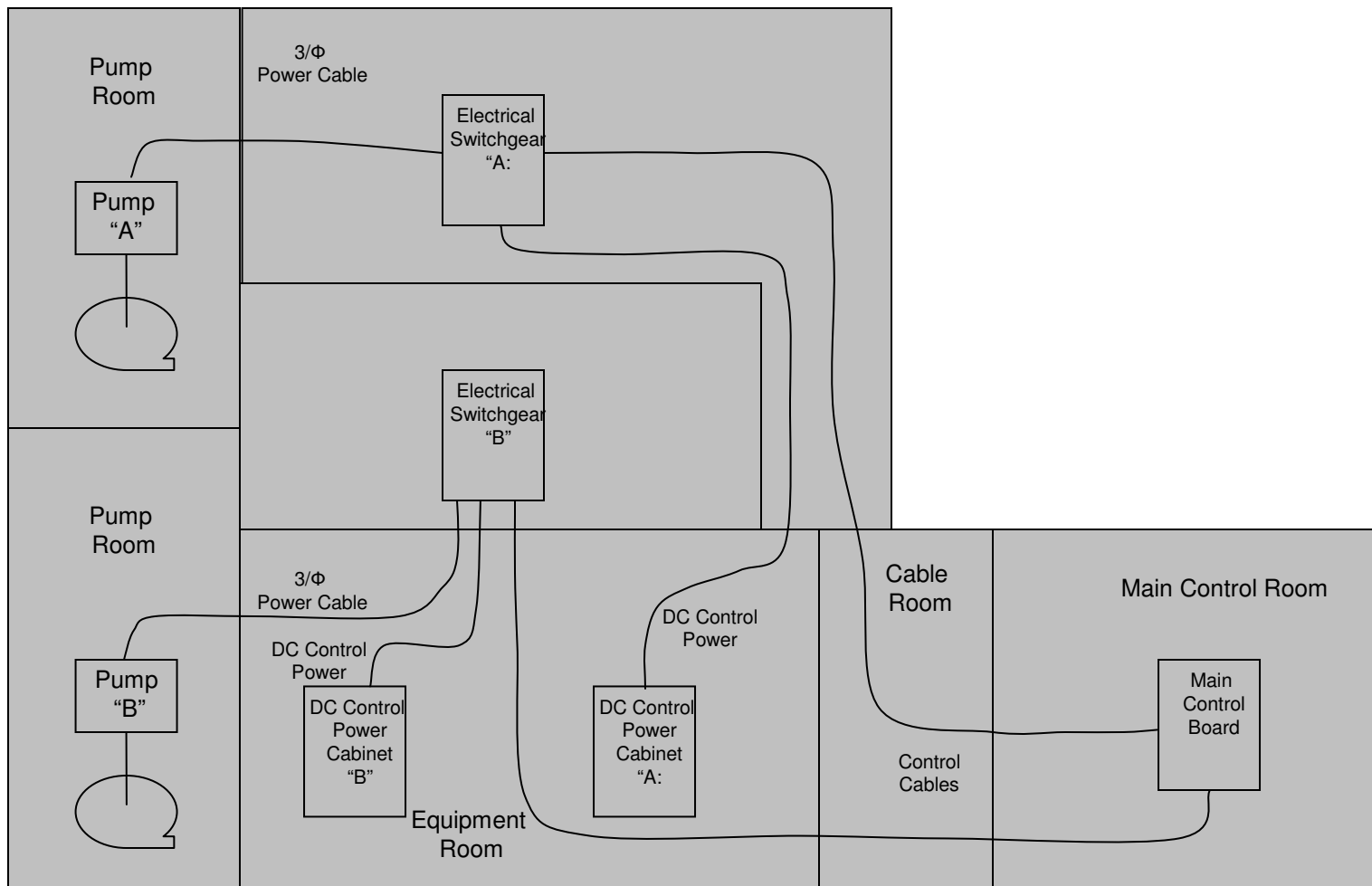


Deterministic Category Impacts

- Fire Areas/Zones where redundant trains are located in separate fire areas crediting III.G.1 with operator manual actions on the fire affected train may be transitioned as deterministic; prior approval not required (note that the manual action will be treated as performance based with respect to feasibility)
- Fire Areas/Zones crediting III.G.2 that have manual actions will need to be transitioned as risk informed/performance based (under the current rules, they require prior NRC approval; under NFPA-805 rules, they will require a Change Evaluation)
- Fire Areas/Zones crediting III.G.3 that have manual actions may be transitioned as deterministic; prior approval not required (but performance based with respect to feasibility)



Deterministic Category Impacts



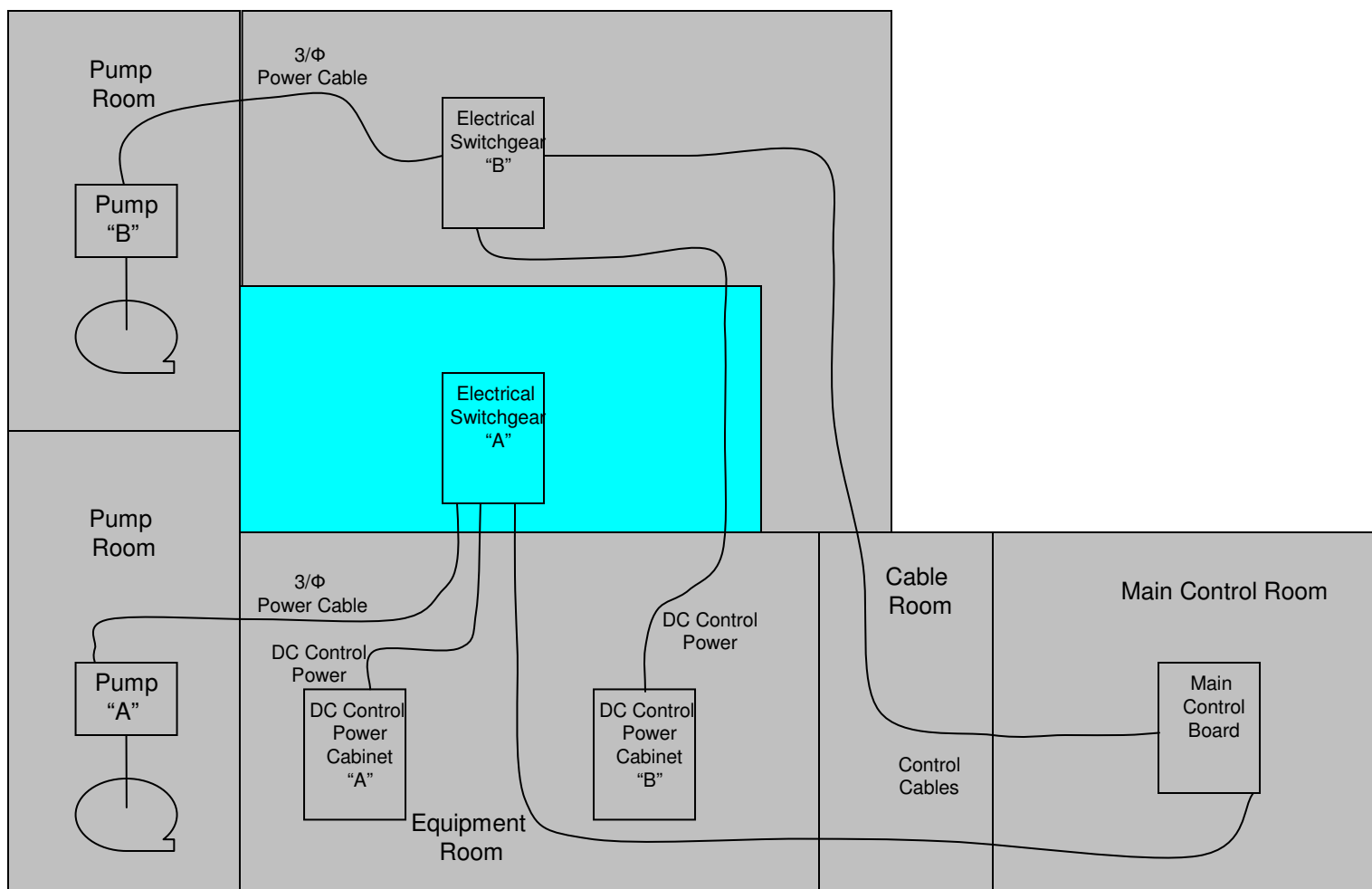


Potential Impact of Recent Staff Interpretations

- Requirement to protect all associated circuit cables that could negatively impact safe shutdown may be impossible to achieve
- Consider a simple example: (See next page)
 - A hypothetical plant has a switchgear room arrangement that requires one of the switchgear rooms to credit III.G.2 for safe shutdown (20 foot of separation...etc.)



Potential Impact of Recent Staff Interpretations

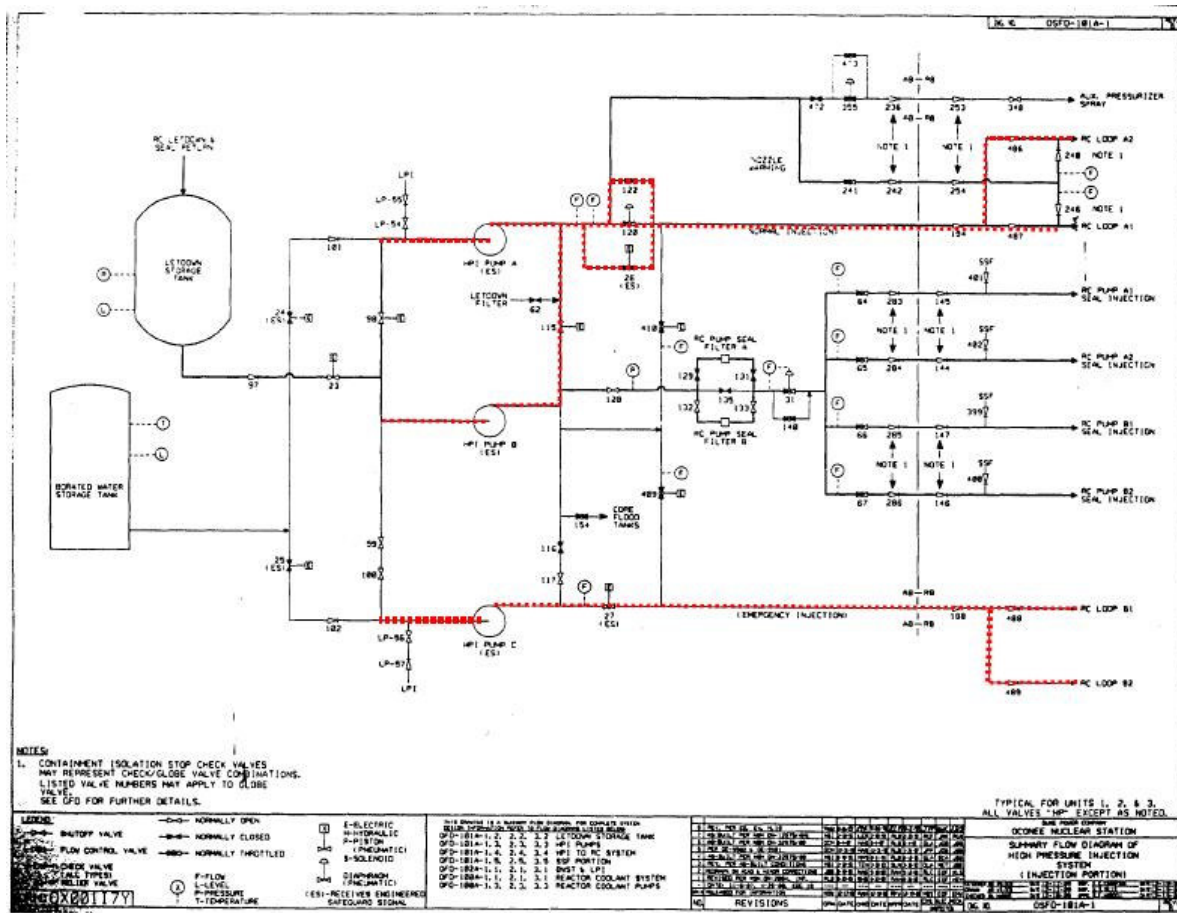




Potential Impact of Recent Staff Interpretations

- Consider a fire in Switchgear Room A
 - Causes a spurious injection into RCS as a direct result of a single hot short that starts HPI Pump A
 - Start of HPI Pump A can have a direct impact on success of safe shutdown due to possible increase in Pressurizer level to the point where passing solid water through the Pressurizer Safety Valve fails the valve open
 - This negative impact results in consideration of spurious HPI pump start as “Associated Circuit”

Potential Impact of Recent Staff Interpretations







Potential Impact of Recent Staff Interpretations

- Consider a fire in Switchgear Room A - continued
 - New interpretation that no manual actions are allowed prevents the ability to terminate the “fire affected train”
 - Normal controls could be damaged by fire
 - Design of injection systems normally means there is no redundant isolation valves in series (uses check valves)
 - Combination of Associated Circuit definition and III.G.2 manual action position would require that the circuit be “protected”



Recommendations

- Consider revising policy to allow local operator manual actions to terminate undesirable impacts of spurious actuation of the “fire affected train”
 - This is not unlike the existing allowance for local operator manual actions in areas crediting III.G.1
- Continuation of the current policy to require protection of associated circuits that are part of the fire affected train is impossible to meet
 - Would require fire wrap/protection in addition to 3-hour barriers separating trains



How This Affects NFPA-805 Transition

- Inability to deterministically treat local operator manual actions to terminate injection/impacts on fire affected trains adds unnecessary change evaluations now and in the future (continuing configuration management)



Summary

-
- Appendix R Reconstitution Data forms the foundation of the Fire PRA
 - Recent Staff Interpretations could have a substantial impact on transition scope, cost and schedule